

## PATENT COOPERATION TREATY

PCT

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

United States Patent and Trademark  
Office  
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Crystal Plaza 2  
Washington, DC 20231  
ÉTATS-UNIS D'AMÉRIQUE

in its capacity as elected Office

<b>Date of mailing</b> (day/month/year) 09 February 1999 (09.02.99)	
<b>International application No.</b> PCT/US98/12866	<b>Applicant's or agent's file reference</b> 37,302
<b>International filing date</b> (day month year) 18 June 1998 (18.06.98)	<b>Priority date</b> (day month year) 20 June 1997 (20.06.97)
<b>Applicant</b> THOMSEN, Leon, A. et al	

1. The designated Office is hereby notified of its election made:

☒

in the demand filed with the International Preliminary Examining Authority on:

18 January 1999 (18.01.99)

☐

in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was☐

was not

made before expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

<b>The International Bureau of WIPO</b> 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer Yolaine CUSSAC Telephone No.: (41-22) 338.83.38
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## PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference <b>37,302</b>	<b>FOR FURTHER ACTION</b> see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. <b>PCT/US 98/ 12866</b>	International filing date (day/month/year) <b>18/06/1998</b>	(Earliest) Priority Date (day/month/year) <b>20/06/1997</b>
Applicant <b>AMOCO CORPORATION et al.</b>		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. ☐ Certain claims were found unsearchable (see Box I).

2. ☐ Unity of invention is lacking (see Box II).

3. ☐ The international application contains disclosure of a **nucleotide and/or amino acid sequence listing** and the international search was carried out on the basis of the sequence listing

☐ filed with the international application.

☐ furnished by the applicant separately from the international application,

☐ but not accompanied by a statement to the effect that it did not include matter going beyond the disclosure in the international application as filed.

☐ Transcribed by this Authority

4. With regard to the title, ☒ the text is approved as submitted by the applicant

☐ the text has been established by this Authority to read as follows:

5. With regard to the abstract,

☒ the text is approved as submitted by the applicant

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this International Search Report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is:

Figure No. 5 ☐ as suggested by the applicant.

☐ None of the figures.

☒ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

## International Application No.

**A. CLASSIFICATION OF SUBJECT MATTER**

According to International Patent Classification (IPC) or to both national classification and IPC

### B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

### C. DOCUMENTS CONSIDERED TO BE RELEVANT

☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

29 October 1998

Date of mailing of the international search report

12/11/1998

Name and mailing address of the ISA

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Fax: (+31-70) 340-3016

Authorized officer

De Bekker, R

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 98/12866

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	THOMSEN L: "Weak elastic anisotropy" GEOPHYSICS, OCT. 1986, USA, vol. 51, no. 10, pages 1954-1966, XP002082613 ISSN 0016-8033 cited in the application	1-9, 13-21, 23,28-40
A	see the whole document ** formula 16... ** see figures 1-5	21,24,25
X	EP 0 296 987 A (SCHLUMBERGER LTD ;SCHLUMBERGER PROSPECTION (FR)) 28 December 1988	22
Y	see abstract; figures 1-4,8  see page 2, right-hand column, line 33 - page 3, left-hand column, line 14 see page 4, left-hand column, line 46 - page 5, right-hand column, line 15 see page 7, left-hand column, line 21 - line 27 & GAVIN PH ET AL: "traitement des diagraphies acoustiques deuieme partie* separation des ondes en diagraphie acoustique" REVUE DE L'INSTITUT FRANCAIS DU PETROLE, vol. 47, no. 2, 1 March 1992, pages 155-178, XP000261199 see figures 1,2	1-9, 13-21, 23,28-40
A	US 4 907 206 A (RAI CHANDRA S ET AL) 6 March 1990 see abstract; figures 1,2,4 see column 2, line 28 - column 4, line 41	1,20-22, 30,31
X	DATABASE WPI Section EI, Week 9349 Derwent Publications Ltd., London, GB; Class S03, AN 93-394377 XP002082614 & SU 1 778 726 A (UKR GEOPROSP RES INST KIEV GEOPHYS DIV), 30 November 1992	22
A	see abstract	1-9,13, 14,20, 21,26-31

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

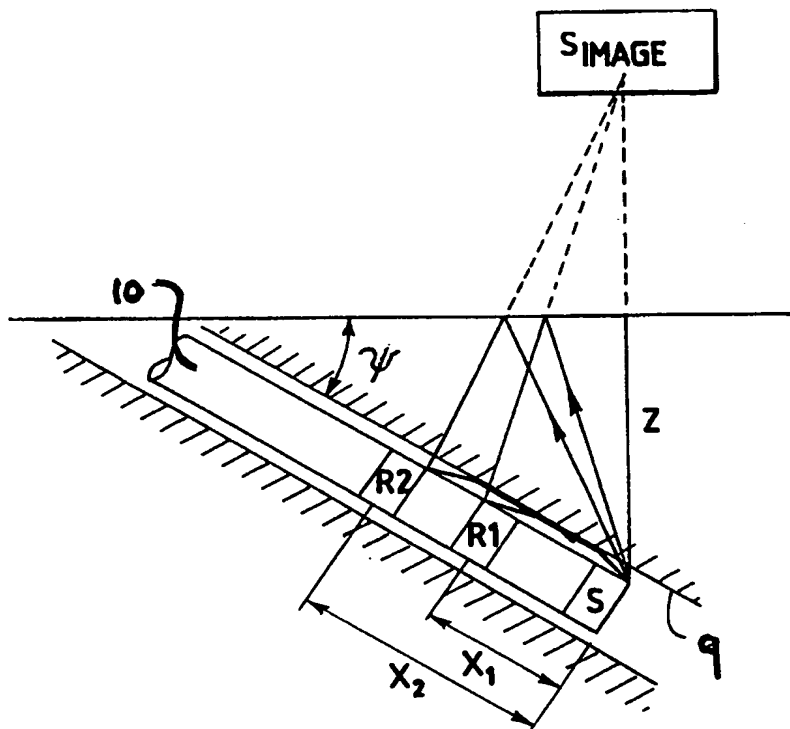
PCT/US 98/12866

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
EP 0296987	A	28-12-1988	US	4817059 A	28-03-1989
			DE	3872964 A	27-08-1992
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US 4907206	A	06-03-1990	CA	1327070 A	15-02-1994
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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>6</sup> : <b>G01V 1/48</b>		<b>A1</b>	(11) International Publication Number: <b>WO 98/59264</b>
			(43) International Publication Date: 30 December 1998 (30.12.98)
<p>(21) International Application Number: PCT/US98/12866</p> <p>(22) International Filing Date: 18 June 1998 (18.06.98)</p> <p>(30) Priority Data: 60/050,389 20 June 1997 (20.06.97) US</p> <p>(71) Applicant (for all designated States except US): AMOCO CORPORATION [US/US]; Law Dept., Mail Code 1907A, 200 E. Randolph Drive, P.O. Box 87703, Chicago, IL 60680-0703 (US).</p> <p>(72) Inventors; and</p> <p>(75) Inventors/Applicants (for US only): THOMSEN, Leon, A. [US/US]; 12707 Melvern Court, Houston, TX 77041 (US). DELLINGER, Joseph, A. [US/US]; 7715 South Yale #1202, Tulsa, OK 74136 (US).</p> <p>(74) Agent: GABALA, James, A.; Amoco Corporation, Law Dept., Mail Code 1907A, P.O. Box 87703, Chicago, IL 60680-0703 (US).</p>		<p>(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, GW, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).</p> <p><b>Published</b> <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i></p>	
(54) Title: HIGH RESOLUTION DETERMINATION OF SEISMIC POLAR ANISOTROPY			
(57) Abstract			

A method and apparatus for high-resolution measurement of seismic anisotropy, comprising: a recording system, a borehole having an axis that is deviated from the vertical by a known acute angle; a housing that is adapted to travel within the borehole and that is in electronic communication to the recording system, the housing carrying at least one source of acoustic energy and at least two receivers for receiving acoustic energy from geological formation elements and/or lithologic horizons and from the source; and processing means for operating the source and the receivers, for recording the position of the housing in the borehole and for processing data from said recording system in terms of both the direct raypaths from the source to the receivers and the indirect raypaths from the source through geological formation elements and/or lithologic horizons to the receivers to obtain measures of at least the seismic polar anisotropy parameters  $V_0$ ,  $\eta$ , and  $\delta$ .



**FOR THE PURPOSES OF INFORMATION ONLY**

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
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DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 98/12866

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	THOMSEN L: "Weak elastic anisotropy" GEOPHYSICS, OCT. 1986, USA, vol. 51, no. 10, pages 1954-1966, XP002082613 ISSN 0016-8033 cited in the application	1-9, 13-21, 23,28-40
A	see the whole document ** formula 16... ** see figures 1-5	21,24,25
X	EP 0 296 987 A (SCHLUMBERGER LTD ;SCHLUMBERGER PROSPECTION (FR)) 28 December 1988	22
Y	see abstract; figures 1-4,8  see page 2, right-hand column, line 33 - page 3, left-hand column, line 14 see page 4, left-hand column, line 46 - page 5, right-hand column, line 15 see page 7, left-hand column, line 21 - line 27 & GAVIN PH ET AL: "traitement des diagraphies acoustiques deuieme partie* separation des ondes en diagraphie acoustique" REVUE DE L'INSTITUT FRANCAIS DU PETROLE, vol. 47, no. 2, 1 March 1992, pages 155-178, XP000261199 see figures 1,2	1-9, 13-21, 23,28-40
A	US 4 907 206 A (RAI CHANDRA S ET AL) 6 March 1990 see abstract; figures 1,2,4 see column 2, line 28 - column 4, line 41	1,20-22, 30,31
X	DATABASE WPI Section EI, Week 9349 Derwent Publications Ltd., London, GB; Class S03, AN 93-394377 XP002082614	22
A	& SU 1 778 726 A (UKR GEOPROSP RES INST KIEV GEOPHYS DIV), 30 November 1992 see abstract	1-9,13, 14,20, 21,26-31



# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 98/12866

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0296987 A	28-12-1988	US 4817059 A DE 3872964 A	28-03-1989 27-08-1992
US 4907206 A	06-03-1990	CA 1327070 A	15-02-1994

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 98/12866

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 6 G01V1/48

According to International Patent Classification(IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)  
IPC 6 G01V E21B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	ALKHALIFAH T AND TSVANKIN I: "velocity analysis for transversely isotropic media" GEOPHYSICS, SEPT-OCT. 1995, SOC. EXPLORATION GEOPHYSICISTS, USA, vol. 60, no. 5, pages 1550-1566, XP002082651	1
A	see abstract  see page 1561 ** discussion and conclusions ** ** appendix b **  ---  -/--	20-22, 30, 31

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

\* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another, citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the international search

29 October 1998

Date of mailing of the international search report

12/11/1998

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Fax: (+31-70) 340-3016

Authorized officer

De Bekker, R

## PATENT COOPERATION TREATY



## PCT

REC'D 24 SEP 1999

WIPO PCT

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 37,302	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/US98/12866	International filing date (day/month/year) 18/06/1998	Priority date (day/month/year) 20/06/1997
International Patent Classification (IPC) or national classification and IPC G01V1/48		
Applicant AMOCO CORPORATION et al.		
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 5 sheets, including this cover sheet.</p> <p><input type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of sheets.</p>		
<p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"><li>I <input checked="" type="checkbox"/> Basis of the report</li><li>II <input type="checkbox"/> Priority</li><li>III <input checked="" type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</li><li>IV <input type="checkbox"/> Lack of unity of invention</li><li>V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</li><li>VI <input type="checkbox"/> Certain documents cited</li><li>VII <input checked="" type="checkbox"/> Certain defects in the international application</li><li>VIII <input type="checkbox"/> Certain observations on the international application</li></ul>		
Date of submission of the demand 18/01/1999	Date of completion of this report 22.09.99	
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Whittington, J Telephone No. +49 89 2399 2781 	

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/US98/12866

**I. Basis of the report**

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

**Description, pages:**

1-12 as originally filed

**Claims, No.:**

1-40 as originally filed

**Drawings, sheets:**

1/3-3/3 as originally filed

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages:  
☐ the claims, Nos.:  
☐ the drawings, sheets:

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

**III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability**

The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

- ☐ the entire international application.  
☒ claims Nos. 2-19,21-40.

because:

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/US98/12866

☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (*specify*):

☒ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. See Section III are so unclear that no meaningful opinion could be formed (*specify*):

**see separate sheet**

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

☐ no international search report has been established for the said claims Nos. .

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**1. Statement**

Novelty (N)	Yes:	Claims
	No:	Claims 1,20
Inventive step (IS)	Yes:	Claims
	No:	Claims 1,20
Industrial applicability (IA)	Yes:	Claims 1,20
	No:	Claims

**2. Citations and explanations**

**see separate sheet**

**VII. Certain defects in the international application**

The following defects in the form or contents of the international application have been noted:

**see separate sheet**

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

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International application No. PCT/US98/12866

**Section III:**

Although claims 1,20,21,22,30 and 31 have been drafted as separate independent claims, they appear to relate effectively to the same subject-matter and to differ from each other only with regard to the definition of the subject-matter for which protection is sought or in respect of the terminology used for the features of that subject-matter. The aforementioned claims therefore lack conciseness. Moreover, lack of clarity of the claims as a whole arises, since the plurality of independent claims makes it difficult, if not impossible, to determine the matter for which protection is sought, and places an undue burden on others seeking to establish the extent of the protection.

Hence, these claims do not meet the requirements of Article 6 PCT.

In order to overcome this objection, it would appear appropriate to file an amended set of claims defining the relevant subject-matter in terms of a single independent claim in each category followed by dependent claims covering features which are merely optional (Rule 6.4 PCT).

**Section V:**

Reference is made to the following documents:

- D1: ALKHALIFAH T AND TSVANKIN I: "velocity analysis for transversely isotropic media" GEOPHYSICS, SEPT-OCT. 1995, SOC. EXPLORATION GEOPHYSICISTS, USA, vol. 60, no. 5, pages 1550-1566, XP002082651
- D2: THOMSEN L: "Weak elastic anisotropy" GEOPHYSICS, OCT. 1986, USA, vol. 51, no. 10, pages 1954-1966, XP002082613 ISSN 0016-8033
- D3: EP 0 296 987 A (SCHLUMBERGER LTD ;SCHLUMBERGER PROSPECTION (FR)) 28 December 1988 & GAVIN PH ET AL: "traitement des diagraphies acoustiques deuieme partie\* separation des ondes en diagraphie acoustique" REVUE DE L'INSTITUT FRANCAIS DU PETROLE, vol. 47, no. 2, 1 March 1992, pages 155-178, XP000261199
- D4: US 4 907 206 A (RAI CHANDRA S ET AL) 6 March 1990

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

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International application No. PCT/US98/12866

D5: DATABASE WPI Section EI, Week 9349 Derwent Publications Ltd., London, GB; Class S03, AN 93-394377 XP002082614 & SU 1 778 726 A (UKR GEOPROSP RES INST KIEV GEOPHYS DIV), 30 November 1992

Document D1 discusses the determination of polar anisotropy parameters in geoseismic applications, and document D3 describes a suitable sonic borehole apparatus for collecting the required data in situ for generating these parameters as petrophysical quantities.

Although a final decision as to the patentability of the claimed subject-matter cannot be made until the objections under Section III are addressed, it would appear prima facie that the combined disclosures of documents D1 and D3 would at least render the subject-matter of claims 1 and 20 non inventive.

**Section VII:**

i) To meet the requirements of Rule 5.1(a)(ii) PCT, the documents D1 and D3-D5 should be identified in the description and the relevant background art disclosed therein should be briefly discussed.

ii) To meet the requirements of Rule 6.3 (b) PCT the independent claims should be properly cast in the two-part form, with those features which in combination are known from the most relevant prior art (e.g. document D1 or D3) being placed in the preamble.